

The image is a composite background. The top and bottom sections show a river with white, turbulent rapids. The central section is dominated by a large, intense fire with bright orange and yellow flames. In the background, behind the fire, are several dark, bare tree trunks and branches.

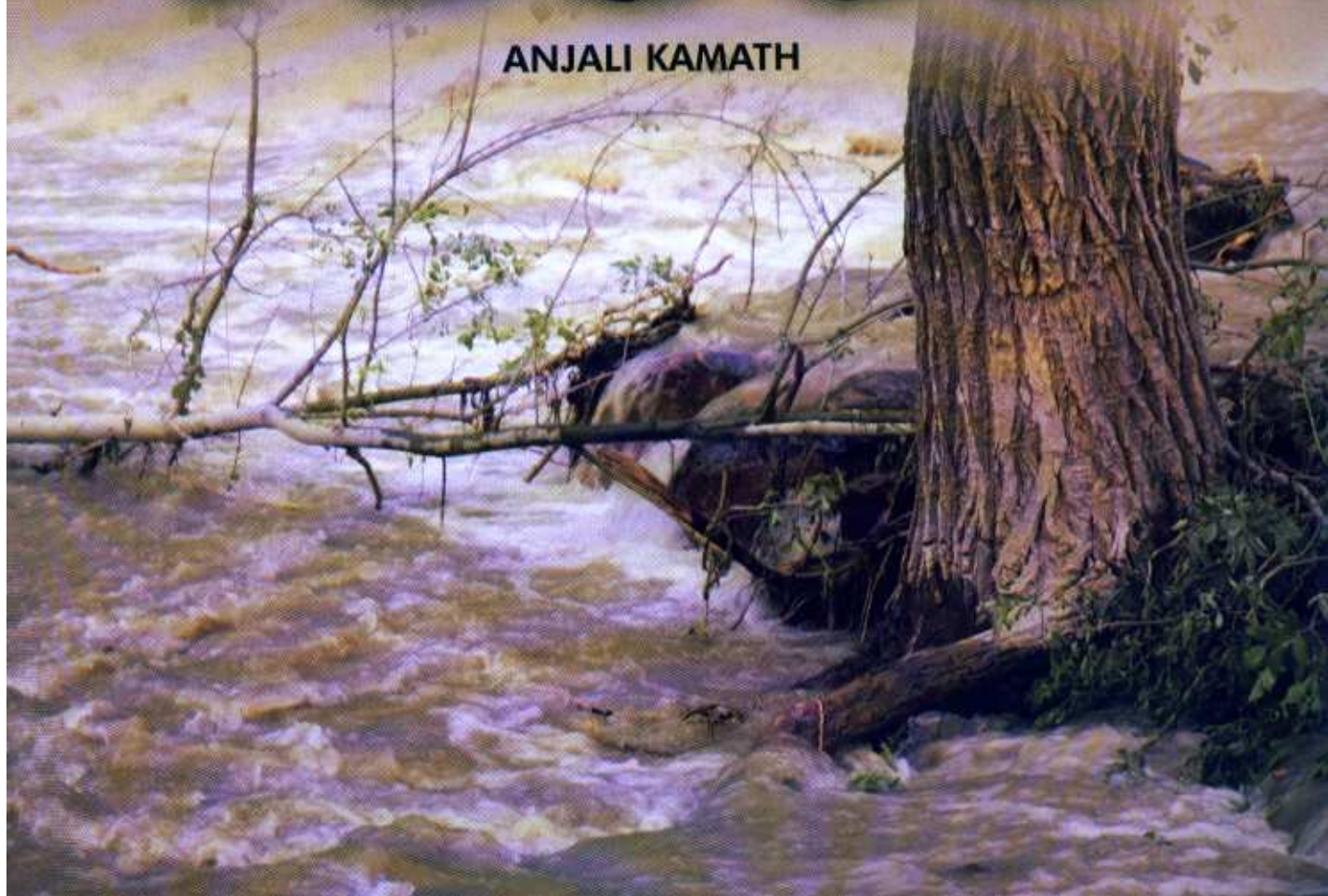
Brainworks
A Kangaroo Kids Initiative

FIRE AND FLOODS

Nature's fury

FIRE AND FLOOD

ANJALI KAMATH





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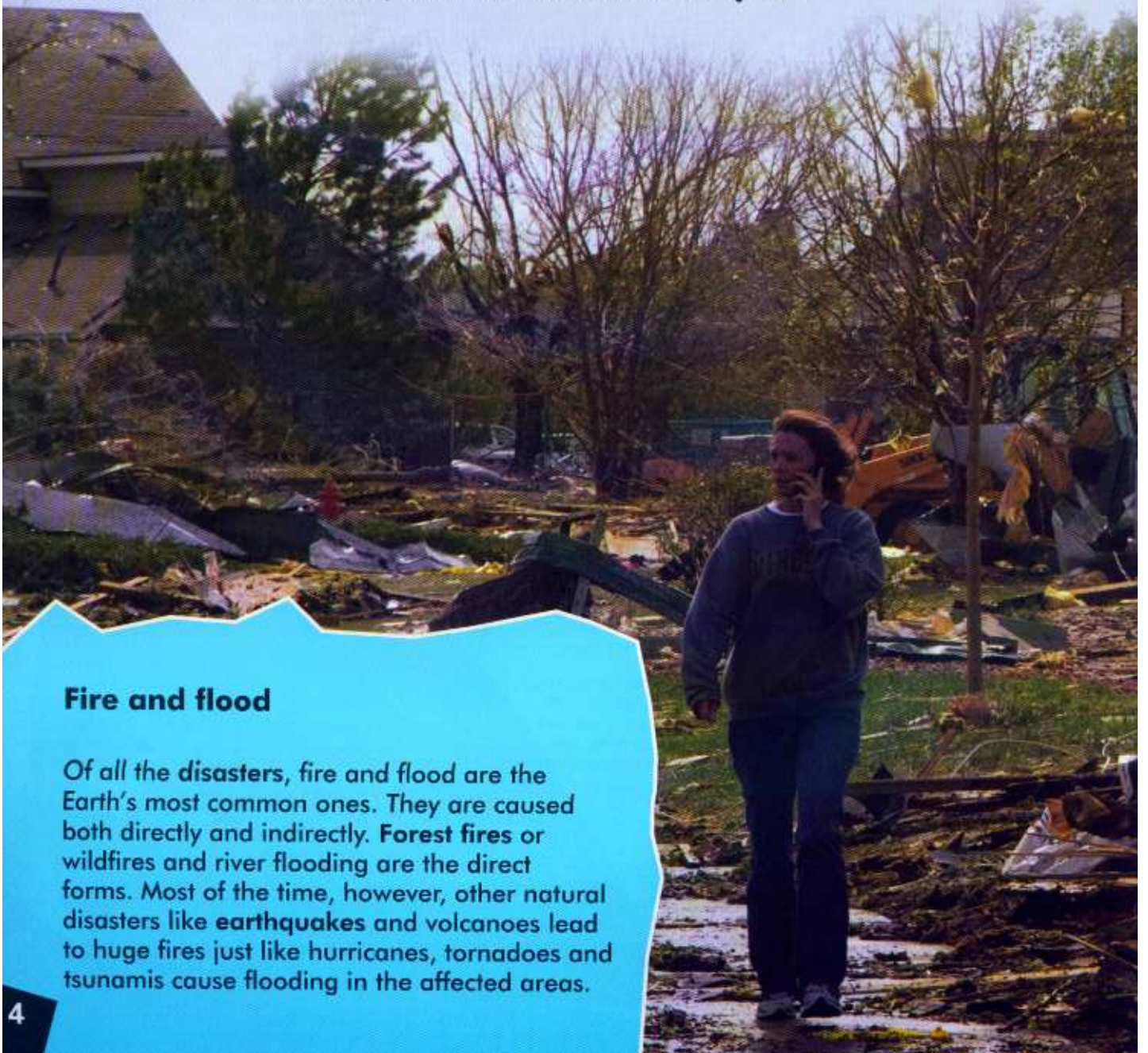


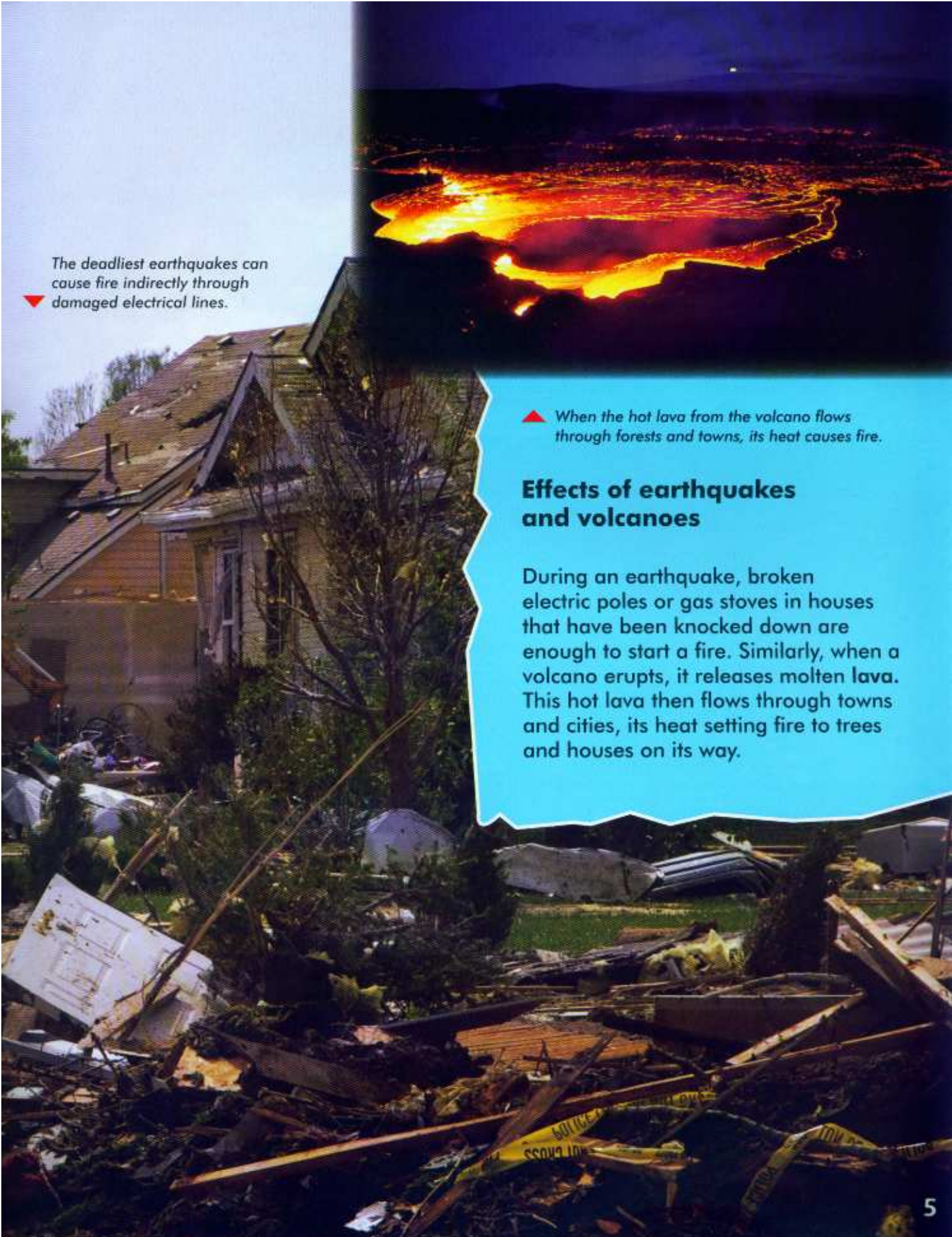
Deadly Disasters

Over the years, natural disasters such as earthquakes, volcanic eruptions, storms, hurricanes, blizzards, tsunamis, fires and floods have caused widespread destruction. It has been estimated that on an average about 150,000 people are killed worldwide by natural disasters each year.

Fire and flood

Of all the disasters, fire and flood are the Earth's most common ones. They are caused both directly and indirectly. Forest fires or wildfires and river flooding are the direct forms. Most of the time, however, other natural disasters like earthquakes and volcanoes lead to huge fires just like hurricanes, tornadoes and tsunamis cause flooding in the affected areas.





The deadliest earthquakes can cause fire indirectly through damaged electrical lines.

▲ When the hot lava from the volcano flows through forests and towns, its heat causes fire.

Effects of earthquakes and volcanoes

During an earthquake, broken electric poles or gas stoves in houses that have been knocked down are enough to start a fire. Similarly, when a volcano erupts, it releases molten lava. This hot lava then flows through towns and cities, its heat setting fire to trees and houses on its way.

Global warming

In the recent past, there has been a dramatic increase in the **frequency** of wildfires and floods. This is mainly due to the unnatural rise in the Earth's temperatures, leading to climatic changes across the world. This **phenomenon** is known as global warming. It is caused by the greenhouse effect.

In the recent past, storms, hurricanes, tornadoes, and tsunamis have caused massive flooding in different parts of the world.

▼ *Scientists believe that this is because of severe climate change.*



Road to disaster

Certain gases in the Earth's atmosphere, such as carbon dioxide, trap some of the Sun's heat as it is reflected back into space. These gases, known as **greenhouse gases**, keep our planet warm. However, harmful human activities like excessive industrialisation and **deforestation** are rapidly increasing the amount of greenhouse gases in the atmosphere. This has resulted in the overheating of the Earth leading to heat waves and melting of glaciers. This in turn is causing a rise in the sea levels and creating drought like situations—all of which can result in fire and flood.

▼ Industries burn fossil fuels to produce energy. This releases harmful gases into our environment.



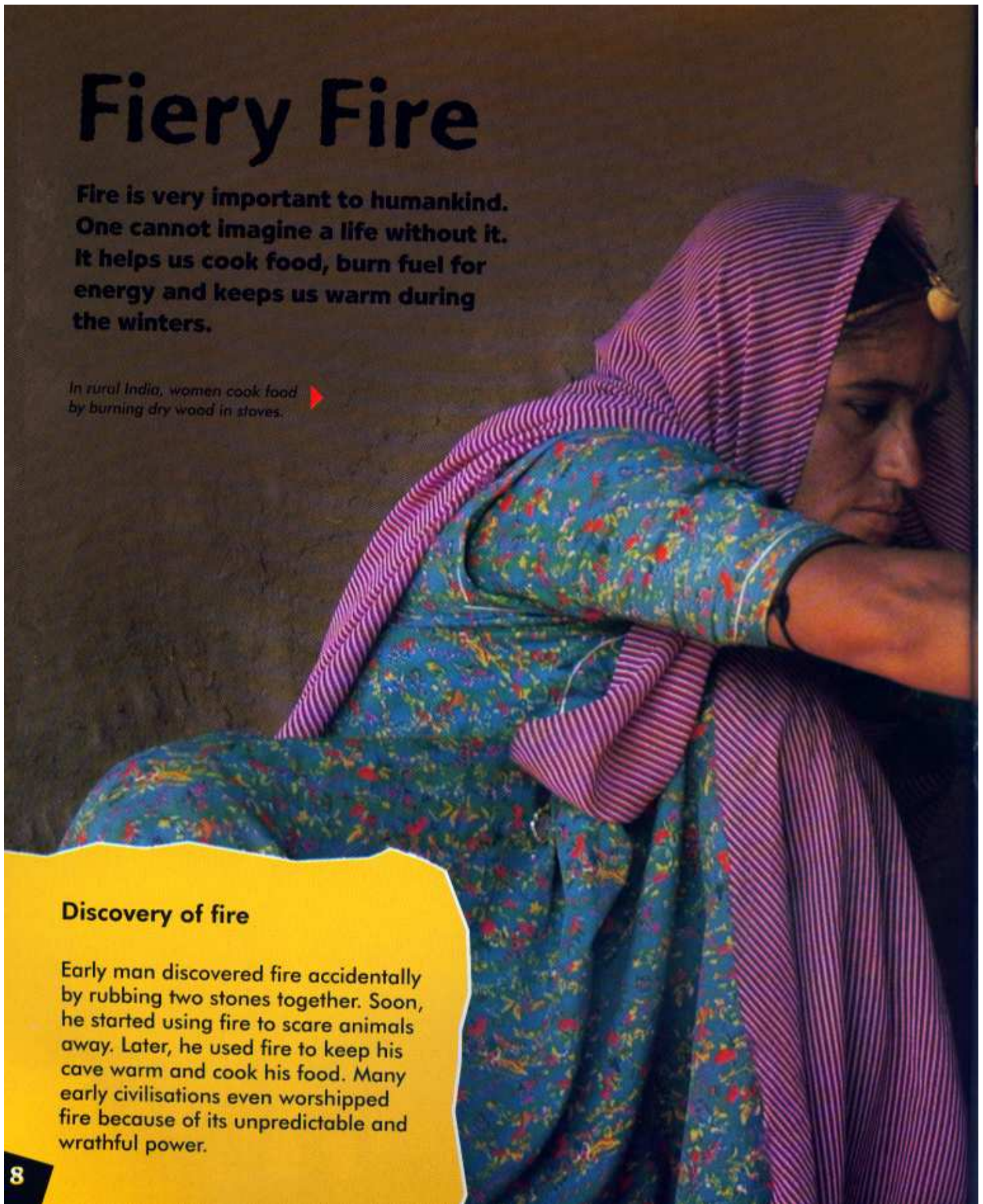
Fiery Fire

Fire is very important to humankind. One cannot imagine a life without it. It helps us cook food, burn fuel for energy and keeps us warm during the winters.

In rural India, women cook food by burning dry wood in stoves.

Discovery of fire

Early man discovered fire accidentally by rubbing two stones together. Soon, he started using fire to scare animals away. Later, he used fire to keep his cave warm and cook his food. Many early civilisations even worshipped fire because of its unpredictable and wrathful power.

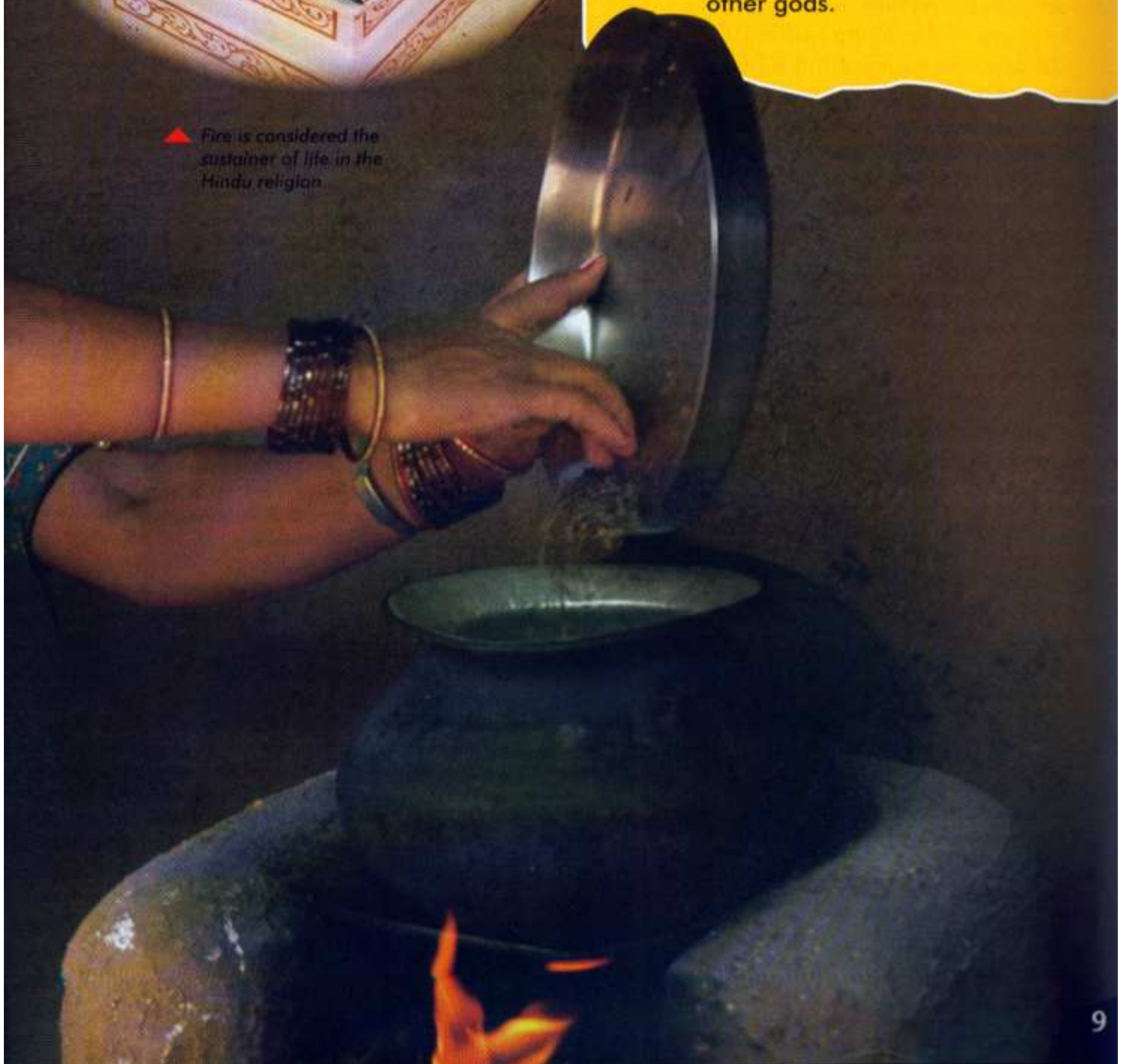




Religious fire

In India, fire has a great amount of religious significance. It is the central element in yagnas, an important Hindu ritual. It is believed that Agni, the god of fire, plays the role of a mediator between the worshipper and the other gods.

▲ Fire is considered the sustainer of life in the Hindu religion.



What makes fire burn

Three elements are essential to help fire burn continuously – fuel, oxygen and heat. In a forest fire, trees and plants act as fuel. In cities, books, papers, furniture and cooking gas are the fuel. Oxygen is essential if a fire has to survive. Fire would die out soon if there is no heat to maintain it. The flame that is emitted during a fire produces heat, which in turn heats up the remaining fuel making the fire grow stronger. This is one of the reasons why fires in the open are more difficult to control. All the three elements–fuel, oxygen and heat are available in plenty in the open.

▼ The dried twigs and branches serve as a fuel for forest fires.

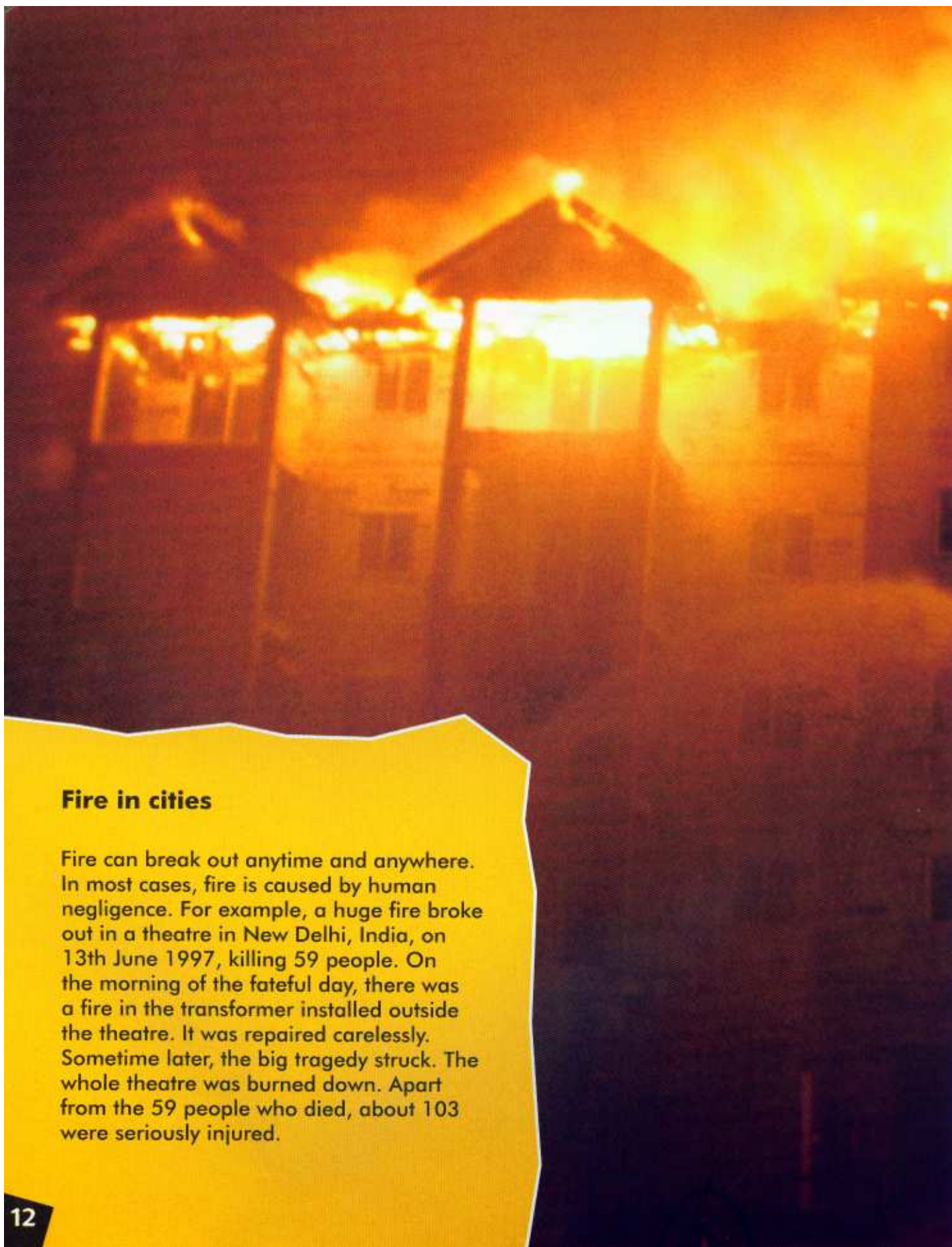




Choking smoke


Smoke is released as a by-product when fire burns. It is a harmful cloud of vapour mixed with particles and poisonous gases. When a building catches fire, more people die of smoke inhalation than of actual burns. Poisonous gas like carbon monoxide, present in the smoke, first leads to loss of consciousness and then death. Sometimes, smoke mixes with fog in the atmosphere and forms **smog**. This smog reduces visibility in cities.

◀ *Smog can cause many harmful health effects. It can decrease the working capacity of lungs.*



Fire in cities

Fire can break out anytime and anywhere. In most cases, fire is caused by human negligence. For example, a huge fire broke out in a theatre in New Delhi, India, on 13th June 1997, killing 59 people. On the morning of the fateful day, there was a fire in the transformer installed outside the theatre. It was repaired carelessly. Sometime later, the big tragedy struck. The whole theatre was burned down. Apart from the 59 people who died, about 103 were seriously injured.



Eighty-four percent of house and building fires are accidental. They are often caused by poor electrical wiring or careless behaviour.

Fire by wars and terror attacks

Fire can also be caused by wars and terror attacks. In the terrorist attacks of September 11, 2001, the twin towers of the World Trade Centre in New York, USA, collapsed completely. The impact of the two planes crashing into the towers led to a fire that made the tall steel-framed skyscrapers fall down like a pack of playing cards. Thousands of people died in this horrific incident.

Each of the two towers of the World Trade Center collapsed less than an hour after being hit due to the intense heat caused by the fire that spurted out after the two hijacked airliners hit them.



Wildfire

A large wildfire is shown with thick, billowing black smoke rising into the sky. The fire is visible in the lower right, with bright orange flames and dark, charred ground in the foreground.

Wildfires, also known as forest fires, occur in forests and grasslands. They can burn complete forests within minutes, destroying everything in their path. Wildfires are very common in Australia, Canada and the United States.

Wildfires are a major environmental problem in many parts of the world. They destroy large tracts of landscape, as well as trigger the release of large amount of greenhouse gases, thereby aggravating global warming.

India's wildfires

Wildfires are not so common in India except for in a few dry forest regions. In 2008, a wildfire broke out in Mityana, a part of the Gir Wildlife Sanctuary in Gujarat. Nearly 400 acres of land was affected but there was no casualty.



Good fire

Wildfires can be divided into two kinds - good fires and bad fires. Good fire maintains some ecosystems, such as savannahs, where fire does not allow the growth of trees. It also reduces the build-up of dry wood in forests. This prevents more damaging wildfires in the future. Good fires are usually controlled to ensure that the fire does not spread to extensive areas.

Bad fire

A bad fire threatens animals, vegetation, human life or property. This fire can also release vast amount of ash into the atmosphere, which can inhibit plant growth, reduce visibility and cause breathing problems in people and animals.

▼ *Bad fire stunts the growth of trees and plants.*



Kinds of wildfires

Wildfires can also be divided on the basis of which section of trees and plants they affect. When a fire affects the top part of the forest, it is known as crown fire. The second type is called surface fire. It burns down grasses and shrubs up to 4 feet tall, and lower branches of trees. It often moves rapidly. The third is the ground fire which burns in roots, litter or organic soil. Once started, this fire is very difficult to detect and control. Spotting is the fourth kind of wildfire and is produced by crown fire, wind and the local topography. In this, large embers called firebrands are blown ahead of the main fire. Once spotting begins, a fire is very difficult to control.

The most common type of wildfire is the surface fire which burns along the floor of a forest, moving slowly and killing or damaging grass, shrubs and trees.



The image is a vertical composite. The left half shows a wildfire with bright orange and yellow flames consuming dry grass and brush in a forest. Tall, dark tree trunks are visible in the background. The right half shows a campfire made of sticks and branches, with a pot hanging over it. The fire is burning brightly. The background of the right half is a blurred forest scene.

Causes of wildfires

Wildfires are large fires and often cover many square kilometres, burning for many days. They are caused by natural **catalysts** like lightning or extreme heat. In most cases, however, wildfires are a result of human activities, such as half-lit cigarettes and campfires.

Neglected campfires
can cause wildfires. ►

Diseased trees and wildfires

Fire is a potential hazard when vegetation becomes dry. This often occurs during droughts and long summers. Wildfires are also likely to occur when trees become diseased due to insects, fungus or pollution. For example, in the western United States, climate change is increasing the population of pine and spruce beetles that are infesting the mountainous evergreen forests with a deadly fungus. These trees are losing all their nutrients and becoming highly susceptible to fires. As a result, the western United States is facing one of the highest wildfire threats in history.

◀ A diseased or a dead tree has a high chance of catching fire.



The worst wildfires

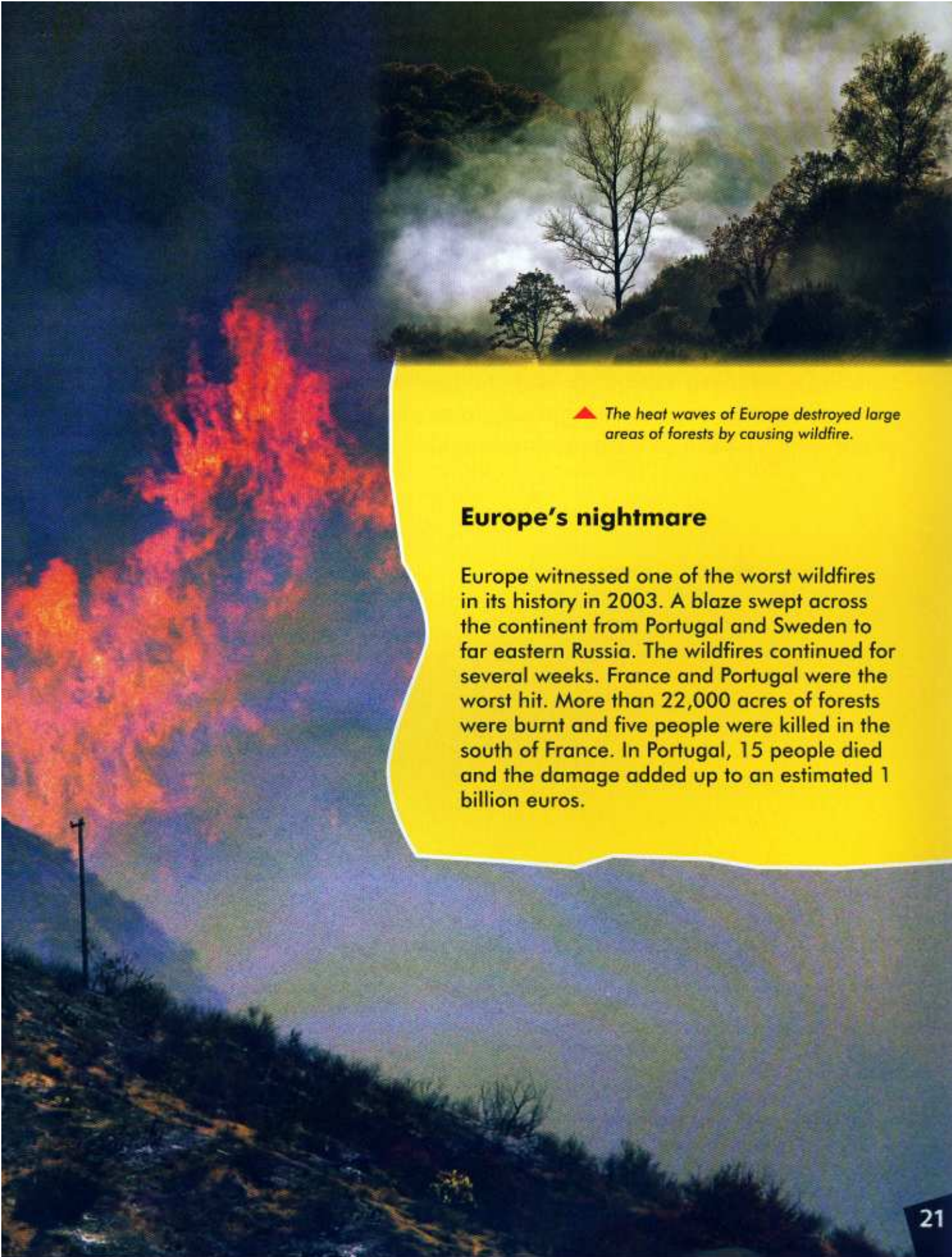
There are many heart-rending tales of fire tragedies in history. Some of the worst wildfires in history have not only destroyed forests but also neighbouring towns and villages, killing thousands of people. Some of these wildfires had natural causes like dry weather but some of them occurred due to the carelessness and harmful activities of human beings. If we do not take proper measures soon, many forest habitats will be completely destroyed.

▼ Helicopters spray fire retardant and water to control wildfires.

Californian Cedar Fire

Forest fires are common in California, USA. Many devastating fires have swept across this state causing immense damage. *The Cedar Fire of California in 2003*, however, was the worst fire in its history. The Cedar Fire was started by Sergio Martinez of California, who had become lost and started the fire to signal rescuers. Fifteen fires burned for two long weeks in the counties of San Diego, Ventura, Riverside and San Bernardino killing around 24 people and destroying over 800,000 acres of land. More than 15,000 firefighters tried to contain this wildfire that burned down over 3,500 homes. The Cedar Fire is a classic example of human negligence.

The Cedar fire of California is one of the worst fires in the history of California. ▶



▲ The heat waves of Europe destroyed large areas of forests by causing wildfire.

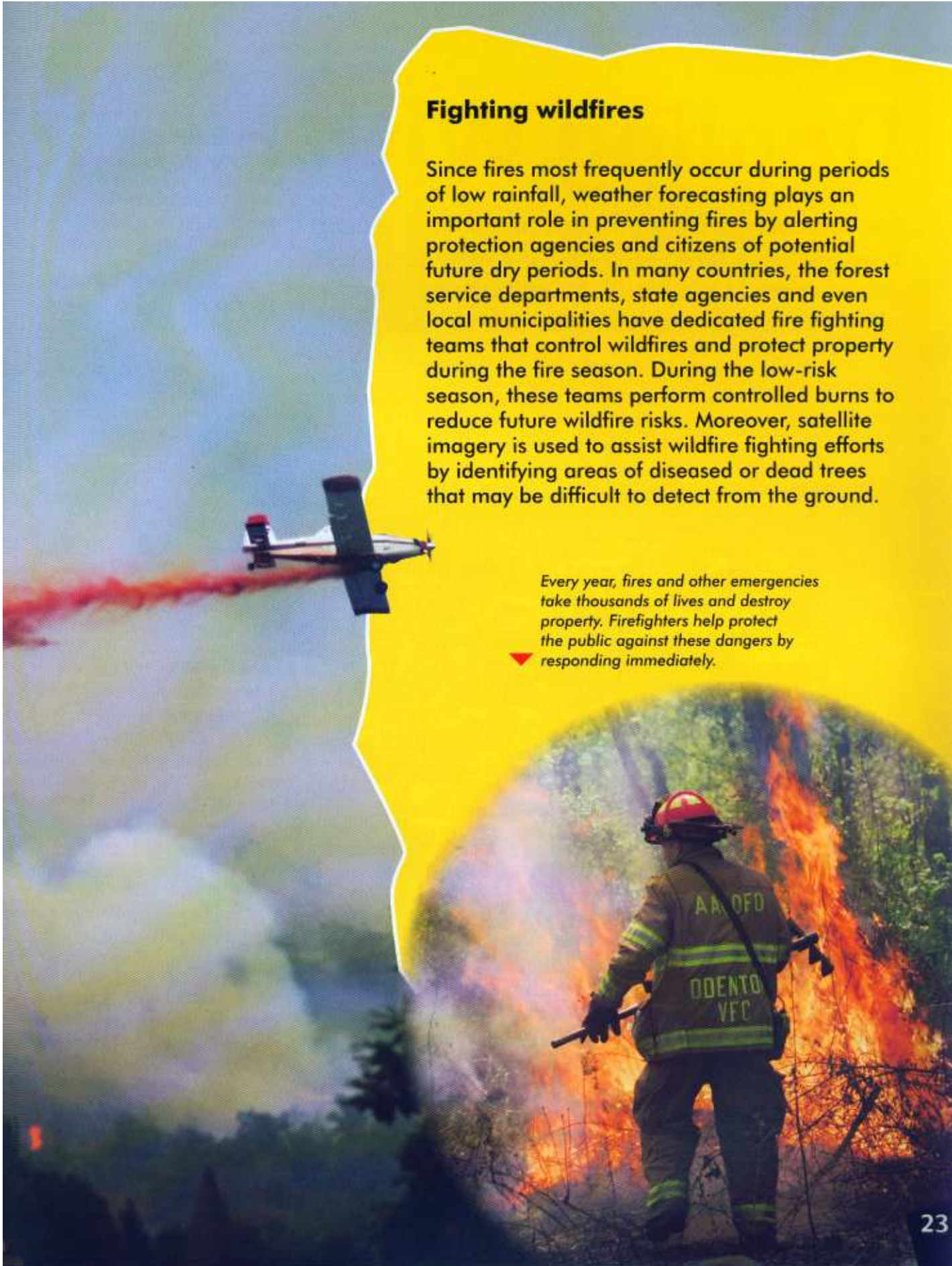
Europe's nightmare

Europe witnessed one of the worst wildfires in its history in 2003. A blaze swept across the continent from Portugal and Sweden to far eastern Russia. The wildfires continued for several weeks. France and Portugal were the worst hit. More than 22,000 acres of forests were burnt and five people were killed in the south of France. In Portugal, 15 people died and the damage added up to an estimated 1 billion euros.

Controlling Wildfire

Protecting lives and property from wildfires can be tough. Experienced firefighters need to check the wind speed and direction as well as use special equipment to douse the fire. However, installing fire-resistant roofs on houses, creating vegetation free safety zones around buildings, keeping adequate water supplies and having planned escape routes can greatly improve the likelihood of surviving wildfires with minimal loss.

▼ *These aircraft help fire fighting ground crews to suppress or extinguish fire by spraying fire retardants.*



Fighting wildfires

Since fires most frequently occur during periods of low rainfall, weather forecasting plays an important role in preventing fires by alerting protection agencies and citizens of potential future dry periods. In many countries, the forest service departments, state agencies and even local municipalities have dedicated fire fighting teams that control wildfires and protect property during the fire season. During the low-risk season, these teams perform controlled burns to reduce future wildfire risks. Moreover, satellite imagery is used to assist wildfire fighting efforts by identifying areas of diseased or dead trees that may be difficult to detect from the ground.

Every year, fires and other emergencies take thousands of lives and destroy property. Firefighters help protect the public against these dangers by responding immediately.

Dealing With Fire

Fire disasters are a big threat to human lives and property. Hundreds of people die in building and factory fires in the world. In India, many slums in big cities are gutted each year due to negligence.

▼ *These slums are prone to fire due to open electric lines and poor housing construction.*

Fire in Tokyo

There have been many instances in the past where big cities have burned down completely. On September 1, 1923, an earthquake measuring 7.9 on the Richter scale struck the Japanese island of Honshu. The quake destroyed Yokohama, a port city, along with the surrounding areas of Chiba, Kanagawa, Shizuoka and Tokyo. Most of the over 105,000 deaths were caused by 88 fires that broke out after the quake.

Preventing fires

To fight raging fires in cities, most countries in the world have made certain rules and regulations that have to be followed while constructing houses, shops and factories.

◀ Always read the instructions that come with the fire extinguisher and familiarise yourself with its components.



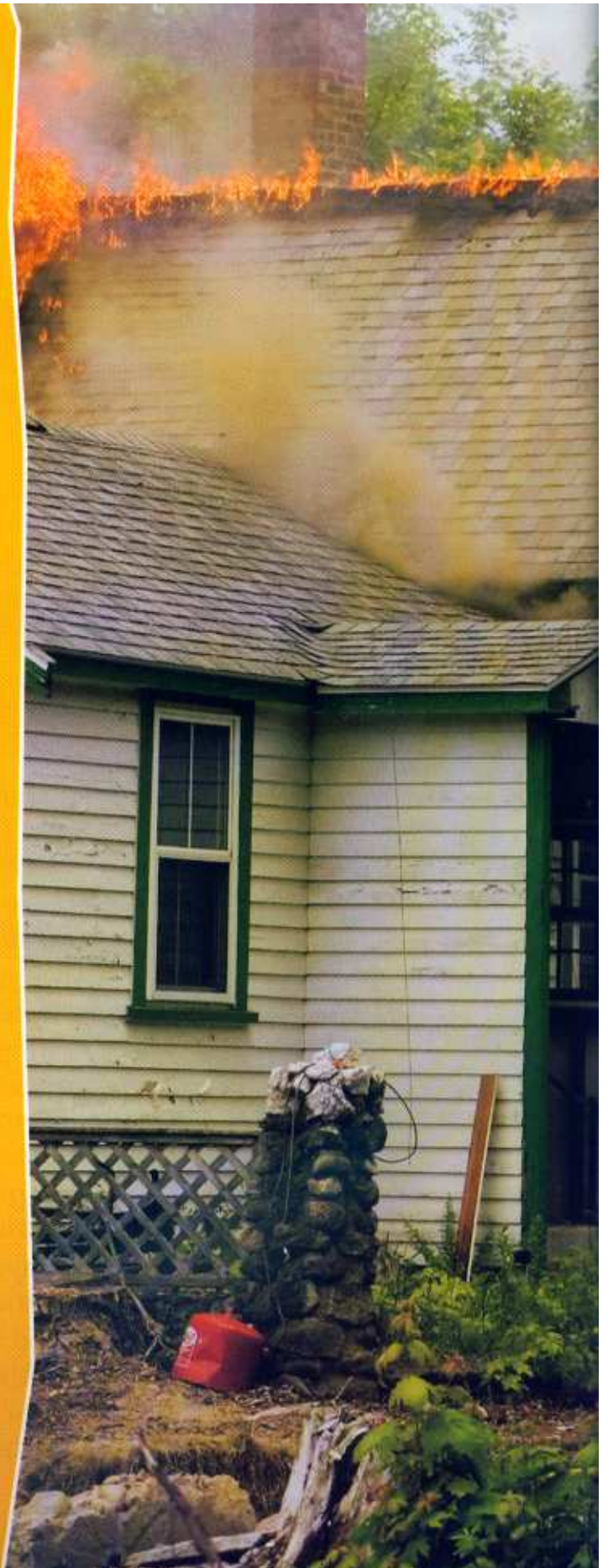
Here are a few things you can do to prevent and fight fire in your house:

- Fit smoke alarms and fire extinguishers. Test the alarms every month and change batteries annually.
- Never leave the cooking stove unattended in the kitchen.
- Always use a candle holder, and keep candles away from anything flammable.
- Keep portable heaters away from furniture and flammable items. Make sure to switch heaters off every time you leave the house.
- At night, before you go to bed, unplug all electrical items that are not in use.
- Always use the appropriate fuses in all electrical appliances.
- Avoid using multi-way plug socket adapters, if possible.
- Never run electrical cables under the carpets.

What to do in an emergency

In case of fire you might want to do the following things. Go inside a room with the least smoke. Seal the room completely by keeping wet towels under the door as this will keep the smoke out. Go near the window and call or signal for help and please remember not to open the window if there is fire beneath it. Call the emergency number of the fire department immediately and give them the address clearly.

One of the precautionary measures towards fighting fire is the ready availability of fire warning signs in all public places to ensure that the public is aware.



A photograph showing a house with a large fire on its roof. A fire truck is parked in front of the house, and a firefighter is visible in the background spraying water on the fire. The scene is set in a residential area with trees and a fence.

Extinguishing fires

Firefighting includes assessing the nature of the fire, the kind of fuel involved and extinguishing the fire. It also involves finding and rescuing people. The most common substance that is used to extinguish fire is water. Moreover, wetting agents such as detergents are used to help water to penetrate objects such as mattresses. In cases where flammable liquids are involved, foam is used to put out the fire.

Fire trucks have important tools like ladders, hoses and water tanks.

Flood

Floods are among the Earth's most destructive natural disasters apart from fires. Some floods develop slowly, giving people time to prepare or evacuate. Others, called flash floods, form quickly and can appear with little or no warning.

▼ *Floods are a threat to people who live near coasts and floodplains.*

Destructive floods

During floods, water seeps into houses and submerges villages, towns and cities. In many cases, floods sweep away houses, trees and cars. Floods also drown people and cattle on their way. The ancient people worshipped floods because of their destructive power. Ancient Chinese believed that floods were caused by dragons that splashed about in the water.

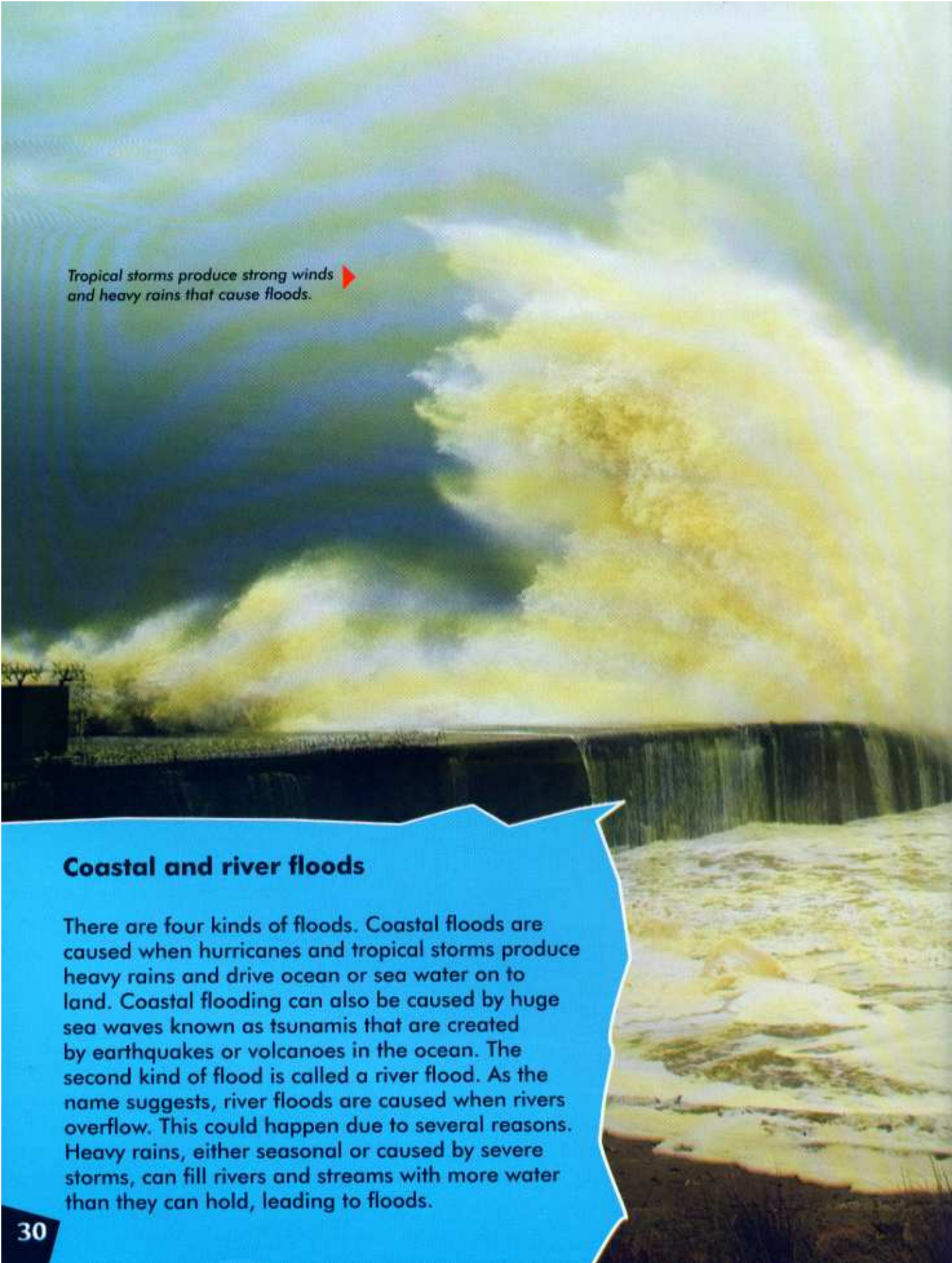


▲ A dam collapse can devastate villages and cities.



Causes of flood

The duration of floods ranges from minutes to months. A flood can be caused by heavy rainfall from thunderstorms, storm surges during a hurricane, melting snow or even when a dam collapses. Flooding is dependent on soil conditions as much as it is on the amount of rainfall received. Moderate rainfall can produce flooding in already saturated soils, while even heavy rainfall may produce no flooding if the soil is relatively dry.



Tropical storms produce strong winds and heavy rains that cause floods.

Coastal and river floods

There are four kinds of floods. Coastal floods are caused when hurricanes and tropical storms produce heavy rains and drive ocean or sea water on to land. Coastal flooding can also be caused by huge sea waves known as tsunamis that are created by earthquakes or volcanoes in the ocean. The second kind of flood is called a river flood. As the name suggests, river floods are caused when rivers overflow. This could happen due to several reasons. Heavy rains, either seasonal or caused by severe storms, can fill rivers and streams with more water than they can hold, leading to floods.



Urban and flash floods

The third kind is the urban flood. This is caused when the land loses its ability to absorb rainfall due to increased parking space in a city. As rainwater cannot be absorbed into the ground, it fills the roads and lanes flooding homes and commercial places. The last but definitely the most dangerous kind is the **flash flood**. These floods occur within six hours of a heavy rainfall, and are usually associated with cloud bursts, storms and cyclones.

▲ In cases of severe floods, buildings, cars and a whole lot of other urban property can be damaged and even destroyed.





Floods in India

In India, around 12 percent (40 million hectares) of the land is prone to floods. Most of the flood affected areas lie in the Ganges basin, Brahmaputra basin, the northwestern river basin, peninsular river basin and the coastal regions of Andhra Pradesh, Tamil Nadu, Orissa and Kerala. Of these, Assam, Uttar Pradesh, Bihar and Orissa are prone to severe floods.

▲ Very heavy downpours often cause streets to be over run with water.

The wrath of the Kosi river

Recently, the Kosi river of Bihar changed its route and caused massive flooding, submerging the north Bihar districts of Supaul, Araria, Madhepura and Purnea. On 18th August 2008, due to continuous heavy monsoon rains, there was a breach in the embankment of the Kosi river located in the north of a dam in Nepal. As a result, about 1,29,800 cusec water was discharged through the breach submerging hundreds of villages. This flood caused massive loss of life and property and affected more than 2.5 million people.

▼ Continuous heavy rainfall can cause floods.



The worst floods in history

The largest flood disasters have happened in China, where the Yangtze River has flooded almost every year in the last 2000 years. However, the Hwang Ho river, also known as the Sorrow of China, has been responsible for more deaths than any other river in the world. In 1887, the Hwang Ho river floods killed almost two million people, while in 1931 the toll was about 4 million.

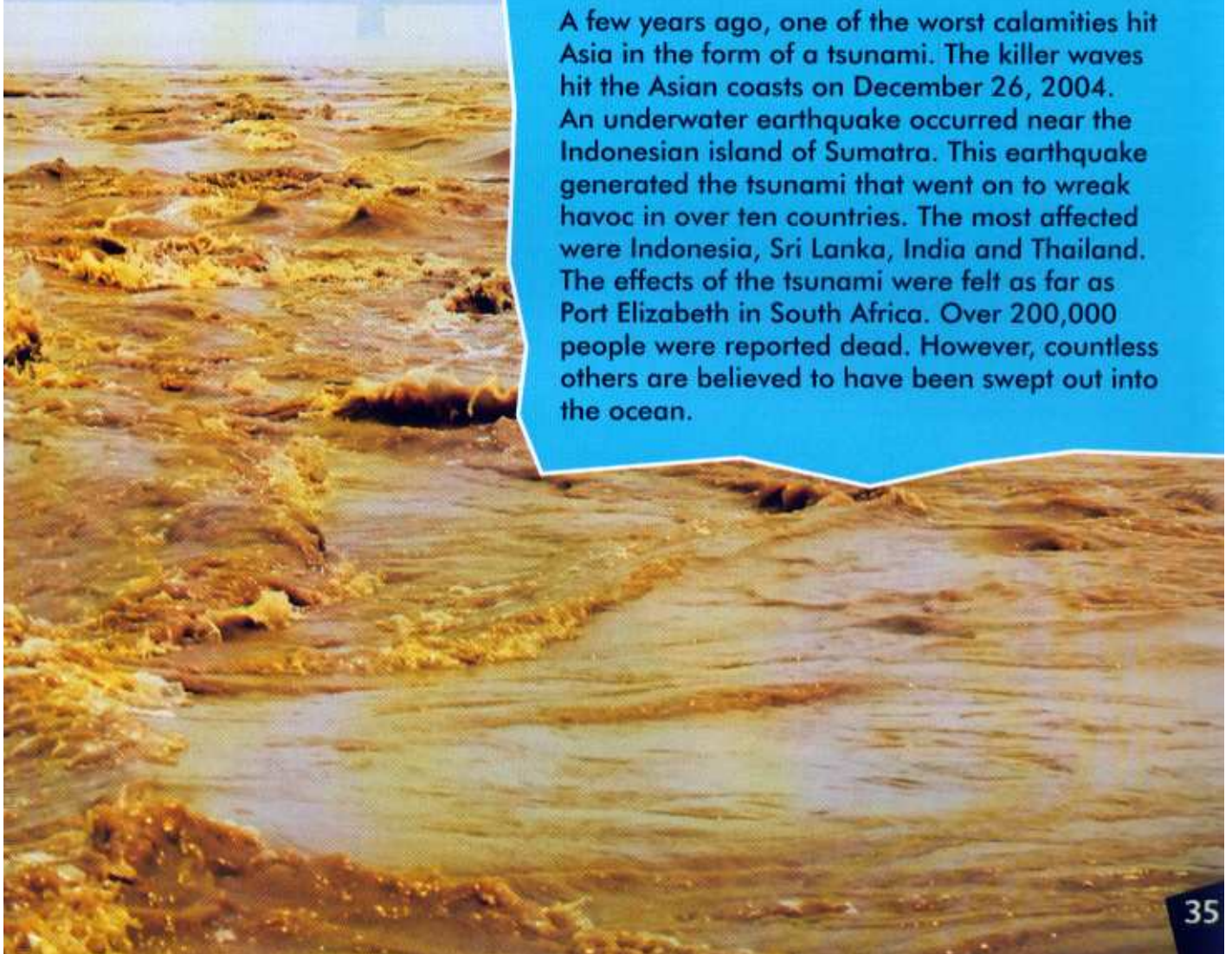
▼ Flooding of the Hwang Ho river in China has killed many people.

Millions of people have been left homeless and scores killed as a result of the deadly tsunami.



Tsunami terror

A few years ago, one of the worst calamities hit Asia in the form of a tsunami. The killer waves hit the Asian coasts on December 26, 2004. An underwater earthquake occurred near the Indonesian island of Sumatra. This earthquake generated the tsunami that went on to wreak havoc in over ten countries. The most affected were Indonesia, Sri Lanka, India and Thailand. The effects of the tsunami were felt as far as Port Elizabeth in South Africa. Over 200,000 people were reported dead. However, countless others are believed to have been swept out into the ocean.



Flash Flood

A flash flood is the fastest moving type of flood. It happens when heavy rain collects in a stream, turning it into a rushing torrent. This quick change from calm to raging river catches people off guard, making flash floods extremely dangerous.

Causes of flash flood

Flash floods are usually the result of heavy rainfall in an area. Most flash floods are caused by thunderstorms that move over the same area again and again, or heavy rains from hurricanes and tropical storms. Sometimes, dam failures can also lead to flash floods.

A flash flood carries with it the fertile top soil. It also carries piles of debris making it extremely dangerous.

Reckless cutting of trees causes the top soil to become loose and thereby easier to be carried off when a flash flood occurs. ▶



Human effects

Human activity is the biggest reason for flash floods. Huge numbers of trees are cut down around the world. Without enough trees and plants to hold the land and act as barriers, floods are becoming more and more destructive.

Power of flash floods

Flash floods move at very high speeds. They have the power to move boulders, tear out trees, destroy buildings, and obliterate bridges. Walls of water can reach heights of 10 to 20 feet and generally carry a huge amount of debris with them.





▲ Flood forecasting predicts the changes in weather patterns and keeps the general public informed.

Flash flood alert

The best response to any signs of flash floods is to quickly go to a higher ground. You need to protect yourself by keeping a track of the weather. Moreover, check the weather forecast before going for a picnic near a riverbank. If the weather forecasters predict storms, then it is safer to stay at home.



Forecasting flash floods

Most of the time, forecasters issue a watch when they think people should watch out for storms. An advisory is issued when smaller problems begin to occur, like minor street flooding. However, with big and dangerous disasters like flash flooding, warnings are issued. So look out for the signs!

Act immediately!

In case of a flash flood warning in your area, do not think but act. Avoid going to flooded areas. Do not attempt to cross running flood water. If you are in a car during the flash flood, never move through the flooded roads. If the car stops working, leave it and move to a higher ground.

▼ *It just takes two feet of flood water to carry away cars and other vehicles.*

Dealing With Floods

Floods are natural disasters but regular flood watches and warnings can save people and animals. Most of the countries spend a great deal of money to mitigate the problems caused by floods.

The construction of embankments in the flood plains stops flood water from entering houses near river banks.

Taming flood

Precautions and proper measures can save you from the floods. If you live on the floodplain, construct levees or floodwalls to stop flood water from entering your house. The walls of the basement should be sealed to avoid seepage. If your area is prone to floods, then regularly check the flood forecast. Check out for the terms – flood watch or flood warning. A flood watch means flooding is possible whereas a flood warning indicates flooding will occur soon.

A black helicopter is shown in flight, carrying a large white bag of relief supplies. The bag is suspended from the helicopter by a rope. The helicopter is flying over a body of water, and a forklift is visible on the ground in the background. The sky is blue with some clouds.

Preparing for the flood

During a flood warning, pack your most important items in a bag and keep it ready. If you have been advised to evacuate then don't wait, immediately leave your house. In case of a flash flood, move to a higher ground. Make sure to switch off all the electrical appliances and switch off all the utilities before you leave the house. This is to avoid fire.

During floods, planes and helicopters carry relief supplies to the people who have been stranded without water or food for days.

Guard yourself during flood

Flood water destroys everything in its path – houses, vehicles, roads, animals, human beings. The loss and damage will depend on the kind and duration of flood. If you have got stuck in a flood, do not try moving through flowing water as you are prone to fall and be washed away. When moving through still water, always use a stick. Otherwise, use boats to rescue yourself and others. This will help you gauge the firm ground below you. Electrical equipments are very dangerous during flood as they can electrocute you when touched. Avoid touching them if you are wet or standing in water.

In a flash flood emergency, helicopters lift victims from the flooded area to safety. ▶



The Aftermath of a terrible flood

The worst effects of the devastating floods are experienced after the water has receded. There will be huge amounts of mud deposited everywhere. Disinfect everything that got wet. Mud left from flood water usually contains sewage and chemicals. After moving back, check whether the community water is safe to drink as many water borne diseases occur during this time because of contamination. Most people die after flood water has receded due to an epidemic.

No power and no roads

Always be careful when driving a car as the roads might be weakened by the flood. If there has been a lot of damage to the power lines in your area, immediately report it to the authorities.

Floods destroy drainage systems in cities, causing sewage to spill out into water bodies. This leads to water borne diseases.



Facts At A Glance

- All fires start with ignition, which occurs when adequate levels of fuel, heat, and oxygen exist at the same time. Ignition occurs when the temperature rises high enough to produce a flame. A chemical reaction takes place when the "fire triangle" is present.
 - Oxygen
 - Fuel
 - Heat
- Oxygen must be present for combustion to occur. A colourless gas, oxygen mixed with fuel gives off heat. With more available oxygen there is more combustion. If the oxygen is removed, the fire will go out.
- Eighty-two percent of all fire deaths occur at homes.
- The U.S. has one of the highest fire death rates in the industrialised world.
- Flash floods can occur many miles away from a storm.
- About half of all flash flood victims are people who get stuck in cars.
- Many cultures have ancient flood stories such as the story of Noah or Gilgamesh. One theory suggest these floods could have been caused by the melting of ice from the last ice age around 12,000 years ago.
- Just 6 inches of rapidly moving flood water can knock a person down.
- Most deaths caused by floods are due to flash floods.



Glossary

blizzard: a storm with widespread snowfall accompanied by strong winds

catalyst: a substance that speeds up a reaction without being consumed or affecting the final product

deforestation: deforestation is when forested areas are converted to non-forest land for farmland or for urban use

disaster: an event resulting in great loss and misfortune

earthquake: the shaking and vibration of the Earth's surface as a result of underground movement

flash flood: a flood that is caused by heavy or excessive rainfall in a short period of time, usually under 6 hours, leading to water that rises and falls quite rapidly

forest fire: a fire, often large, that consumes a forest or woodland

frequency: the number of occurrences of a particular event within a given time period

global warming: An overall increase in world temperatures, which may be caused by additional heat trapped by greenhouse gases

greenhouse gases: the gases present in the Earth's atmosphere that trap heat from the Sun and warm the Earth

lava: lava is molten rock spurted by a volcano when it explodes

phenomenon: a phenomenon is any occurrence that can be observed

significance: importance

smog: a thick blanket of smoke and fog



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